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## MULTI-POINT SLIDING DOOR LATCH

## Background of the Invention

This invention relates to multi-point door latches and more particularly to a multi-point door latch especially suitable for use with sliding doors.

5           In a typical sliding patio door installation, the door is maintained in a latched and/or locked condition by a latch mounted in the lock face of the stile of the sliding door and having a single hook or other latching element coacting with a keeper structure on the associated door jamb.       Whereas these so called single point constructions are satisfactory for most installations, there is increasing need and demand for more security with respect to sliding patio doors to preclude forced entry. In an effort to increase the latch security, so-called multi-point latches have been developed and utilized in which more than one latching element engages the keeper structure of the jam to provide a more secure latching arrangement and provide more security against forced entry. Whereas these multi-point latch structure do increase the strength of the latch and thereby guard against forced entry, they tend to be very complicated and expensive and further, are difficult to install since they require substantial modification of the stile of the sliding door to accommodate the latch.

## 25 Summary of the Invention

This invention is directed to the provision of an improved sliding door multi-point latch.

More specifically, this invention is directed to the provision of a sliding door multi-point latch that is simple, inexpensive and requires minimal modification of the existing door structure.

5           The invention latch is adapted to be fitted in a single opening in the lock face of the stile of the door and is arranged for coaction with a keeper structure on an associated jamb and for coaction with a handle assembly mounted on the stile of the door and including a tail  
10 member operated by a thumb turn or a key lock.

          The invention latch includes a unitary hollow housing sized to fit in the single stile opening; a pair of vertically spaced upper and lower hooks each mounted in the housing for movement between a retracted unlatched position  
15 within the hollow of the housing and an extended latched position extending out of the hollow of the housing for latching coaction with the keeper structure; and actuator means positioned in the housing intermediate the upper and lower hooks, adapted to receive a tail member from the  
20 handle assembly, and operative in response to turning movement of the tail member to move the upper and lower hooks in unison between their unlatched and latched positions. This arrangement provides multi-point security while minimizing latch expense and minimizing the required  
25 modification of the existing door structure.

          According to a further feature of the invention, the hooks are pivotally mounted in the housing and the hooks move in opposite directions about their respective

pivot axes. The opposing hook arrangement precludes vertical movement of the door to defeat the latch.

According to a further feature of the invention, the actuator means comprises upper and lower actuators  
5 positioned in vertically spaced side-by-side relation in the housing and each pivotally mounted in the housing and the actuators are ganged together by a gang link so that pivotal movement of one actuator generates corresponding pivotal movement of the other actuator. This twin actuator  
10 arrangement allows the latch to be used with handle assemblies having a center mounted thumb turn/key lock as well as with handle assemblies having an offset mounted thumb turn/key lock.

According to a further feature of the invention,  
15 the housing includes a sidewall and the sidewall defines upper and lower holes for passage of upper and lower fasteners utilized to attach the handle assembly to the stile of the door. This arrangement allows the fastener elements of the handle assembly to act to increase the  
20 security of the latch.

According to a further feature of the invention, the latch further includes an upper link interconnecting the upper actuator and the upper hook and a lower link interconnecting the lower actuator and the lower hook, the  
25 upper housing sidewall hole is positioned vertically between the actuator means and the upper hook, and the lower housing sidewall hole is positioned vertically between the actuator means and the lower hook. This

arrangement provides a compact packaging for the latch while retaining the ability to utilize the handle fasteners to augment the security of the latch.

According to a further feature of the invention,  
5 the actuator means includes a pivot arm mounted at one end thereof for pivotal movement in the housing about a pivot axis and including a radially extending slot provided at another end of the arm; the housing defines an arcuate slot centered on the pivot axis and intersecting the pivot arm  
10 slot; the latch further includes a pin passing through the housing and pin arm slots and means operatively connecting the pin to the one of the hooks; the housing further defines a tail end slot portion communicating with one end of the arcuate slot and extending inwardly therefrom toward  
15 the pivot axis; and the latch further includes spring means biasing the pivot arm for movement about the pivot axis in a direction to cause the pin to move inwardly into the tail end slot portion following movement of the pin to the one end of the arcuate slot. This arrangement allows the latch  
20 to move automatically to a locked configuration following movement of the hooks to their latched positions.

#### Brief Description of the Drawings

FIGURE 1 is a somewhat schematic view, looking  
from inside to outside, of a typical sliding patio door  
25 installation;

FIGURES 2 and 3 are side elevational and plan  
views, respectively, of the invention latch;

FIGURE 4 is an exploded perspective view of a sliding door assembly utilizing the invention latch;

FIGURES 5-8 are progressive views showing the movement of the invention latch from an unlatched, to a latched, to a locked position;

FIGURE 9 is a detail view taken within the circle 9 of Figure 8;

FIGURE 10 is a plan view of the invention latch with a latch trim plate removed to reveal the inner workings of the latch;

FIGURE 11 is a cross-sectional view of the latch housing;

FIGURE 12 is a detail view of an adjuster link utilized in the invention latch;

FIGURES 13-15 are detail views of an actuator utilized in the invention latch; and

FIGURES 16 and 17 are detail views of a hook utilized in the invention latch.

#### Detailed Description of the Preferred Embodiment

Figure 1 illustrates a typical sliding patio door installation in which fixed left and right doors 10 and 12 are positioned at the left and right ends of an opening 14 in a building wall 16 and a sliding door 18 is arranged to move between the open position seen in Figure 1 to a closed position in which the stile 18a of the sliding door is positioned against a jamb 12a defined by the fixed door 12 so that a latch 20 carried by stile 18a may coact with a

keeper structure 22 defined on the jamb 12a to maintain the sliding door in a closed position.

According to the invention, latch 20 is a multi-point latch that is simple in design, inexpensive, and readily installed, with a minimum of door modification, in a wide variety of sliding patio doors.

The invention multi-point sliding door latch is adapted to be fitted in a mortise or opening 18b (Figure 4) in the lock face 18c of the stile 18a of the sliding door and is arranged for coaction with keeper structure 22 positioned on the associated jamb 12a and for coaction with a handle assembly 23 including an escutcheon plate 24 mounted on the inside face of the stile 18a of the sliding door, a handle 25 mounted on the escutcheon plate, and a thumb turn 26 mounted centrally on the escutcheon plate and including a tail member 27 operated by the thumb turn. It will be understood that the door handle assembly 23 seen in Figures 1 and 4 is an inside door handle assembly and that the sliding door 18 further includes an outside door handle assembly 28 (Figure 10) including an escutcheon plate 29 mounted on the outside face of stile 18a, a handle 30 mounted on the escutcheon plate, and a key lock 31 mounted centrally on the escutcheon plate, operated by a key 32, and controlling a tail member 33.

Latch 20, broadly considered, includes a housing assembly 34, upper and lower hooks 36 and 38, upper and lower hook adjustment means 39, actuator means 40 operative in response to turning movement of tail member 27/32 to

move the upper and lower hooks in unison between latched and unlatched positions, and locking means 41.

The various elements of the latch are preferably formed of suitable ferrous materials.

5           Housing assembly 34 includes a unitary rectilinear hollow housing 46 and a trim plate 48.

Housing 46 is formed of two or more parts in a stamping operation and includes (Figures 2, 3, 4, and 11) a top wall 46a, a bottom wall 46b, a rear wall 46c, a front wall 46d, and sidewalls 46e and 46f coacting to define a  
10           vertically elongated hollow interior 46g accessible through upper and lower rectangular apertures 46h and 46i in the front wall 46d.

Trim plate 48 has a vertically elongated planar  
15           configuration, is positioned in overlying relation to the front wall 46d of housing 46 utilizing screws 50, and includes upper and lower rectangular apertures 48a and 48b respectively overlying housing apertures 46h and 46i. Housing 46 is sized to fit within opening or mortise 18b in  
20           the lock face 18c of the stile of the sliding door with trim plate 48 overlying the lock face in surrounding relation to opening 18b and screws 52 passing through holes 48c in the upper and lower ends of the trim plate to secure the latch to the lock face.

25           Upper hook 36 (Figures 16 and 17) has a laminar construction and includes a bifurcated hub portion 36a, defining a central aperture 36b, and a hook portion 36c.

Upper hook adjustment means 39 includes identical left and right adjustment arms 54 (Figure 12) interconnected by a central pin 56 passing fixedly through upper hook aperture 36b, a pivot pin 58 pivotally mounting  
5 the lower end of each arm in suitable apertures in housing sidewalls 46f, 46g, and a slot 54a formed in the upper end of each arm. A nut 60 is received at its peripheral edges in the slots 54a of the left and right arms and the nut is moved forwardly and rearwardly via an adjustment screw 62  
10 passing through trim plate 48 and through an aperture in end portion 46j of the upper wall of the housing.

It will be seen that turning movement of adjuster screw 62 threadably moves nut 60 forwardly and rearwardly to pivot arms 54 about the axis of pins 58 and thereby, via  
15 pin 56, move hook 36 forwardly and rearwardly within the hollow of the housing. A lock nut 63 maintains the pivot arms in any position of adjustment.

Lower hook 38 and lower hook adjustment means 39 are identical to the upper hook and the upper adjustment  
20 means except for their orientation within the housing. Specifically, note that with the hooks in their latched positions (Figure 7) the hook portion 36c of the upper hook points downwardly and the hook portion 38c of the lower hook points upwardly in opposing relation to hook portion  
25 36c.

Actuator means 40 includes upper and lower actuators 64 and 66, a gang link 70, an upper link 72, and a lower link 74.



Q Lower actuator 66 (Figures 13-15) is in the form of a pivot arm and includes a hub portion 66a and spaced eccentric arm portions 66b. Hub portion 66a defines left and right trunnions 66c for journaling in suitable 5 apertures 46k in the left and right sidewalls 46e, 46f of housing 46 so as to mount the hub portion of the pivot arm for rotation within the housing about a pivot axis 76. A radially extending slot 66d is provided in each eccentric arm 66b and a rectangular <sup>drive</sup> slot 66e, sized to <sup>drivingly</sup> receive tail 10 member 27/33, extends through the hub portion 66a in symmetric relation to pivot axis 76.

Upper actuator or pivot arm 64 is identical to lower pivot arm 66 but is reverse mounted in the housing, as compared to lower pivot arm 66, so that a lug portion 15 66f extending radially outwardly from hub 66a points generally downwardly whereas the corresponding hub portion 64f of the upper pivot arm points generally upwardly.

The pivot axis 76 of upper pivot arm 64 is preferably located on the vertical center line of latch 20 housing 46 and the pivot axis 76 of lower pivot arm 66 is preferably located offset below (for example, by 3/4") the vertical center line of the latch housing.

Gang link 70 extends between upper and lower pivot arms 64, 66 in parallel relation to the rear edge 46i 25 of the housing, is pivotally connected at its upper and lower ends to the eccentric arm portions of the upper and lower pivot arms by pivot pins 80, and has a length corresponding to the distance between the pivot axes 76, 76

of the upper and lower pivot arms so that the gang link 70 coacts with the upper and lower pivot arms and with the portion of the housing between axes 76, 76 to form a parallelogram linkage.

5           Upper link 72 has a compound curvilinear configuration and includes a lower end 72a carrying a pivot pin 82 received in the slots 66d of the upper pivot arm and an upper end 72b carrying a pivot pin 84 mounted in aligned apertures 36d in the bifurcated hub portion 36a of the  
10 upper hook.

Lower connector link 74 is generally straight, includes a pivot pin 86 at its upper end 74a received in the slots 66d of lower pivot arm 66, and carries a further pivot pin 88 at its lower end 74b pivotally mounted in  
15 aligned apertures in the bifurcated hub portion of the lower hook.

The described actuating means operates in response to insertion of a tail member from the thumb turn or from the key lock into slot 64e or 66e to move the upper  
20 and lower hooks between the fully retracted or unlatched position of Figure 5, to the intermediate or transient position of Figure 6, and thereafter to the latched position of Figure 7.

It will be seen that, as viewed in Figures 5-7,  
25 upper hook 36 moves from its unlatched to its latched position in a clockwise direction whereas lower hook 38 moves from its unlatched to its latched position in a counter-clockwise direction. As the hooks move to their

latched positions, hub portion 36c of upper hook 36 enters and passes through an upper opening 22a in keeper plate 22 for latching coaction with the keeper plate and hub portion 38c of lower hook 38 enters and passes through a lower opening 22b in keeper plate 22 for latching coaction with the keeper plate.

Locking means 41 (Figure 9) comprises an arcuate slot 46l centered on the pivot axis 76 of upper pivot link 64; an arcuate slot 46m centered on the pivot axis 76 of pivot link 66; a coil spring 89 mounted in compression between a lug 46n struck from housing wall 46e and a pin 64g provided on the free end of lug 64f; and a further coil spring 91 mounted in compression between a lug 46p struck from housing wall 46e and a pin 66g provided on the free end of lug 66f. Slot 46l has a tail end section 46q extending from the upper end of the slot in a direction perpendicular to the rear edge 46i of the housing and slot 46m has a tail portion 46r extending from the upper end of the slot in a direction perpendicular to housing rear edge 46i. Pin 86 carried by the upper end 74a of lower connecting link 74, in addition to passing through slots 66d of pivot arm 66, is also received at its opposite ends in slot 46m in housing sidewall 46e and in a corresponding slot in housing sidewall 46f, and pin 82, carried by the lower end 72a of upper connecting link 72, in addition to passing through slots 64d of pivot arm 64, is also received slidably at its opposite ends in slot 46l in the housing

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wall 46e and in a corresponding slot in housing sidewall 46f.

As the hooks reach their latched positions of Figure 7, the pins 82, 86 carried by the lower end of upper link 72 and the upper end of lower link 74 respectively reach the upper ends of their respective slots 46l, 46m and at that time are open to slot tail portions 46q, 46r. At this time, compressed spring 91 acts through its radius arm with respect to the pivot axis 76 of pivot arm 66 to continue the counter-clockwise pivotal movement of arm 66 with the result that the pin 86 and thereby the link 74 are moved rearwardly into the tail end 46r of slot 46m while, simultaneously, compressed spring 89 acts through its radius arm with respect to the pivot axis 76 of link 64 to continue the counter-clockwise pivotal movement of link 64 and thereby move pin 82 and thereby link 72 rearward into the tail portion 46q of link 46l. This seating of the pins 82,86 in the groove tail portions 46q,46r is best seen in Figures 8 and 9. It will be seen that, in this position, any force exerted on lower hook 38 in a direction to attempt to move the hook clockwise toward its unlatched position simply presses pin 86 tighter against the lower wall of slot tail portion 46r to positively preclude the unlatching movement of the hook. Similarly, any attempt to move upper hook 36 counter-clockwise in an unlatching direction results in the pin 82 being pressed more tightly against the lower wall of the tail portion 46q of the slot 46l so as to positively preclude such unlatching movement.

The latch may be readily moved to its unlatched position, to allow opening of the sliding door, by clockwise turning movement of the tail piece associated with the thumb turn or the key lock. Specifically, the  
5 initial clockwise pivotal movement of the pivot arms causes the slots 64d, 66d to move the pins 82, 86 out of the tail portions of the slots 46l, 46m and into the main body portion of the slots whereby the pivot arms may now undergo further clockwise movement to move the hooks to the  
10 transient or intermediate position of Figure 6 and thereafter to the fully unlatched position of Figure 5.

In the assembled relation of the latch and door handle assembly, the handle fastener members 90 pass through upper and lower holes 24a in escutcheon plate 24,  
15 through oversize or oblong upper and lower holes 18d in the stile, through oversized or oblong upper and lower holes 46s in the housing sidewall 46f, and through aligned oversized or oblong upper and lower holes 46s in the housing sidewall 46e for engagement with a suitable  
20 coacting fastener element such as a nut. With this arrangement, prying of the latch 20 out of the opening or mortise 18b is precluded not only by the threaded engagement of screws 52 with the stile but further by the passage of fasteners 90 through the housing of the latch so  
25 that the latch, in effect, can only be pried loose from the stile by destroying the stile and/or the latch housing. The upper, oversized housing holes 46s will be seen to be located vertically between upper pivot arm 64 and upper

hook 36 and the lower, oversized housing holes 46s will be seen to be located vertically between lower pivot arm 66 and lower hook 38.

The invention will be seen to provide a multi-  
5 point latch for a sliding door that is simple in construction, inexpensive, and readily installed in a wide variety of door environments. Specifically, the housing of both upper and lower hooks in a single unitary housing allows the latch to be installed in standard sliding door  
10 stiles simply by enlarging the opening or mortise in the lock face of the stile; the ganged together upper and lower actuators allow the same latch to be used either in association with a door handle assembly employing a centrally mounted thumb turn/key cylinder (with tail member  
15 27/33 passing through oversized central escutcheon aperture 24b and oversized central stile aperture 18e) or a handle assembly employing an offset thumb turn/key cylinder arrangement with upper pivot arm 64 utilized to accommodate center line mounting and lower thumb turn 66 utilized (with  
20 suitable machining of apertures 24c and 18f in the escutcheon plate and stile respectively) to accommodate offset thumb screws/key cylinder arrangements; the passage of the handle fastening elements through the housing of the latch adds significantly to the strength and security of  
25 the latch; standard hole locations for the handle and stile may be maintained; the upper and lower latches provide secure multi-point latching; and the opposed disposition of

the upper and lower hooks precludes vertical movement of the door to defeat the latch.

Whereas a preferred embodiment of the invention has been illustrated and described in detail, it will be  
5 apparent that various changes may be made in the disclosed embodiment without departing from the scope or spirit of the invention.